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talia. The genitalia, though thus elaborately illustrated, are hardly referred to in the descriptions. On page 135 *Pterophorus ambrosiæ* is put down as a synonym of *P. inquinatus*, a conclusion that seems more than doubtful when Pl. IV, Figs. 3, 4, and Pl. VI, Figs. 14, 15, are compared.

The index of genera and of species issued with the separately paged reprints might have been omitted, as the references are to the original pagination, not to the pagination of the reprint. January, 1898, on both the report and reprint, should not be considered as the date of publication, as the first advance copies were not sent out from the state printers until March 31, 1898.

Finally the publication in an agricultural report of a systematic account of a family of so slight economic interest as the Pterophoridæ may well be criticised, especially when so many species of prime importance to agriculturists await adequate treatment.

S. H.

BOTANY.

The Morphology of Spore-producing Members. — With the improvements in microscopical technique and the increasing availability of tropical types there have been during the last decade great additions to our knowledge of the structure of all groups of plants, and the pteridophytes have not been neglected. As might be expected, these investigations have not always confirmed the older views, and perhaps nowhere is this more marked than among the ferns. Until quite recently it has been generally accepted that the Leptosporangiatæ, especially the Hymenophyllaceæ, were the more primitive ferns from which the Eusporangiates, the Ophioglossaceæ, and Marattiaceæ, have sprung. The result of these recent studies has been to throw much doubt upon this view, and to make it reasonably certain that the latter groups are really the older ones, while the leptosporangiate ferns represent comparatively recent specialized types, which have arisen from eusporangiate ancestors.

No more important contributions to this very interesting subject have been made than the series of studies upon spore-producing members, of which the present paper[1] is the third. Professor Bower has already given us a very accurate account of the development of the sporangia in the lycopods, Equisetineæ, and Ophioglossaceæ, together with most important conclusions as to the origin of the different sporangial types and the relations of these to one another. In the present paper he has taken up the second order of the Eusporangiatæ, the Marattiaceæ, and has given us by far the most complete account of the sporangia of these interesting ferns that has ever been published. All of the existing genera are treated at length, and in addition there is a most valuable discussion of the relation of these to the different fossil types.

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[1] Bower, F. O., Sc.D., F.R.S. Studies in the Morphology of Spore-producing Members, Marattiaceæ. *Phil. Trans. Roy. Soc.*, Ser. B, vol. 189, 1897, pp. 35–81, Pls. 7–11.

The Marattiaceæ comprise at present four genera, two of them monotypic, of tropical ferns of very characteristic structure. Of these, Marattia is represented in both the Old and New World, but the others are more restricted in range. Danæa is peculiarly American; Angiopteris and Kaulfussia, each with but a single species, belong to the Old World.

The Marattiaceæ show many primitive structural characters, and it is now known that most of the palæozoic ferns were closely related to existing marattiaceous types. Owing to the difficulties in procuring suitable material for studying the development of the sporangia, the earlier studies on these were mostly fragmentary, and entirely confined to the two genera Marattia and Angiopteris. This makes the careful study here given of the sporangia of Danæa and Kaulfussia of more than common interest.

In all the Marattiaceæ except Angiopteris the individual sporangia are imperfectly delimited, and the sorus is often spoken of as a "synangium," although it is much more probable that this is the primitive condition than a case of cohesion of originally free sporangia. Bower very properly considers each group of sporogenous cells as a single sporangium, and speaks of it as a sporangium.

The development of the sporangium is much alike in all of the genera. The sporogenous cells arise, as a rule, from a single hypodermal cell, whose sister-cell forms part of the wall of the ripe sporangium. Exceptions occur and it is not always possible to refer the sporogenous complex to the division of a single mother-cell.

In Danæa the sori are much elongated, and almost completely cover the lower surface of the sporophyll, extending from the midrib to the margin, and almost or quite touching each other laterally. In this genus the sporophylls have the segments decidedly smaller than the sterile leaves, and in this respect Danæa recalls many leptosporangiate ferns, or the Ophioglossaceæ. The occasional presence of imperfect septa in the loculi and a partial overarching of the sorus by the leaf tissue recall the structure of the sporangium in Isœtes, which it has been suggested more than once may possibly be remotely related to the Marattiaceæ.

Kaulfussia differs from Danæa principally in the much wider expanse of the leaf surface and a consequent separation of the small, nearly circular sori; but in essential structure the sporangia of the two are much alike, and Bower considers that the two are nearly related.

Marattia and Angiopteris have been studied more or less completely by other investigators, but they were also examined carefully by Professor Bower, and some additional information in regard to the development of both of them was obtained. In Marattia the presence of a mechanical tissue, having to do with the dehiscence of the sporangium, and an occasional partial septation of the loculus, as in Danæa, are the most noteworthy of these new facts. In Angiopteris abnormalities were sometimes noted, the most striking being sporangia of unusual size, suggesting a condition intermediate between the normal sporangia and the synangia of the other genera. Angiopteris alone is provided with a genuine, though rudimentary, annulus, and there are special thin-walled cells upon the ventral surface of the sporangium where it opens.

A comparison of the number of spores produced is made, from which it appears that Angiopteris and Kaulfussia mark the extremes. The former produces approximately 1450, the latter 7850 spores in each sporangium, numbers far in excess of those in any leptosporangiate ferns.

An interesting comparison is made with the lower members of the leptosporangiate series of ferns, and it is pointed out that the type of sporangium found in the Marattiaceæ has certain resemblances to that of the Osmundaceæ, Gleicheniaceæ, and Schizæaceæ, a point which may well be borne in mind in future studies as to the affinities of the lower Filicineæ.

A most valuable summary of the more important facts connected with the fossil Marattiaceæ is given, from which it appears that while certain of the fossil genera, *e.g.*, Danæites, conform closely in structure to existing types, others are to some extent synthetic in character. Thus Scolecopteris combines characters belonging to Marattia, Kaulfussia, and Angiopteris, while others show characters which would seem to indicate that they are forms connecting the Marattiaceæ with the lower leptosporangiates.

In summing up the evidence obtained from a comparative study of the living and fossil Marattiaceæ, Professor Bower recognizes the difficulties in reaching positive conclusions. However, while admitting that any conclusions reached must be subject to modification, his own view (p. 69) is that the circular sorus, like that found in the fossil Asterotheca, probably is the primitive type from which the others have been derived. The difference in form of the sorus, especially the extreme elongation in Danæa, is correlated with extension of the leaf surface. In another direction, by repeated constriction of the elongated sorus, the numerous scattered sori of Kaulfussia may have arisen.

It is to be regretted that our author did not make a fuller comparison of the Marattiaceæ and Ophioglossaceæ. He expresses no opinion as to the affinities of the two, beyond calling attention to the resemblances between the sporangial spike of Ophioglossum and the elongated sorus of Danæa, which resemblance he does not regard in the light of a true homology.

We are promised a study of the Leptosporangiatæ which will be awaited with keen interest by all students interested in these most important problems, which bear directly upon the question of the origin of the flowering plants as well as the ferns.

Stanford University, Douglas Houghton Campbell.
May, 1898.

Recent Inexpensive Popular Literature on Mushrooms. — The following papers more or less useful to collectors and eaters of fleshy fungi have come to our table within the year:

"Suggestions to Collectors of Fleshy Fungi," by Prof. L. M. Underwood. Reprinted from *Bull. 80 Alabama Agri. Exp. Station.* Cambridge Bot. Supply Co., Cambridge, Mass., July, 1897. 14 pp. Price, 25 cents.

"Mushrooms and Their Use," by Charles H. Peck, State Botanist of New York. 8vo, 80 pp., 32 cuts. Reprinted from *Cultivator and Country Gentleman*, Albany, N. Y., 1894. Cambridge Bot. Supply Co., May, 1897. Price, 50 cents.

"How to Grow Mushrooms," by William Falconer. *Farmers' Bulletin No. 53*, Division of Vegetable Physiology and Pathology. U. S. Dept. of Agriculture, Washington, D. C., March, 1897. 8vo, 19 pp., 14 figs. Free on application.

"Observations on Recent Cases of Mushroom Poisoning in the District of Columbia," by F. V. Coville. *Circular No. 13.* U. S.